

## IN THE CLAIMS:

1       1. (Currently Amended) A rotary tool for drilling into a  
2 soil formation from its surface, controllably injecting water and  
3 dry binder at known depths below the surface of said formation,  
4 and mixing said soil, water and dry binder to form an in-situ  
5 piling, said tool comprising:

6               a rotary shaft having a central axis of rotation  
7 adapted to be driven bi-directionally around said axis, and bi-  
8 directionally along said axis;

9               a vane on and extending radially from said shaft to be  
10 rotated around and moved axially by said shaft, said vane being  
11 so disposed and arranged as to move through the formation along a  
12 helical path to drill into said formation, to stir the material  
13 of the formation, and ultimately to mix the material of the  
14 formation with water and dry binder;

15               a water injector and a binder injector carried by said  
16 tool, each injector having a respective axis of emission of water  
17 or of dry binder, said axes of emission being directed away from  
18 said tool into said formation at a respective location along said  
19 central axis;

20               said injectors being so disposed and arranged relative  
21 to one another that the material of their emissions will during a  
22 limited number of revolutions of said shaft, encounter one  
23 another, there to be mixed as a pre-determined ratio of water and

24 of dry binder, said water including water emitted from the water  
25 injector and water which may have already been present at that  
26 location;

27 said injectors being set in said shaft with their axes of  
28 emission substantially normal to said central axis, and located  
29 along said central axis such that the emission of one of them  
30 will, within a limited number or rotations of the shaft encounter  
31 and mix with the other in a temporally suitable time related to  
32 the curing of the binder and drainage of the water;

33 there being pair of said water injectors and at least one of  
34 said binder injectors set in said shaft, with said binder  
35 injector located axially between said water injectors.

1           Claim 2 (cancelled)

2           Claim 3 (cancelled)

3           Claim 4 (cancelled)

4           Claim 5 (cancelled)

5           Claim 6 (cancelled)

6           Claim 7 (cancelled)

7           Claim 8 (cancelled)

8           Claim 9 (cancelled)

1           10. (Currently Amended) In combination:

2           A-retary-tool-according-to-claim-1--and

3                   a rotary tool for drilling into a soil formation from  
4                   its surface, controllably injecting water and dry binder at known  
5                   depths below the surface of said formation, and mixing said soil,  
6                   water and dry binder to form an in-situ piling, said tool  
7                   comprising:

8                   a rotary shaft having a central axis of rotation  
9                   adapted to be driven bi-directionally around said axis, and bi-  
10                   directionally along said axis;

11                   a vane on and extending radially from said shaft to be  
12                   rotated around and moved axially by said shaft, said vane being  
13                   so disposed and arranged as to move through the formation along a  
14                   helical path to drill into said formation, to stir the material  
15                   of the formation, and ultimately to mix the material of the  
16                   formation with water and dry binder;

17                   a water injector and a binder injector carried by said  
18                   tool, each injector having a respective axis of emission of water  
19                   or of dry binder, said axes of emission being directed away from  
20                   said tool into said formation at a respective location along said  
21                   central axis;

22                   said injectors being so disposed and arranged relative  
23                   to one another that the material of their emissions will during a  
24                   limited number of revolutions of said shaft, encounter one  
25                   another, there to be mixed as a pre-determined ratio of water and  
26                   of dry binder, said water including water emitted from the water

27        injector and water which may have already been present at that  
28        location;

29            a control valve respective to each of said injectors,  
30        whereby the rate of supply of water and of dry binder can  
31        independently be regulated by said control valves to provide  
32        binder at a rate desired at a respective depth and water at a  
33        rate desired which with existing water already in the formation  
34        at that depth, will constitute at least sufficient water for  
35        stoichiometric reaction of the binder;

36        said injectors being set in said shaft with their axes of  
37        emission substantially normal to said central axis, and located  
38        along said central axis such that the emission of one of them  
39        will, within a limited number of rotations of the rotary tool  
40        encounter and mix with the other in a temporally suitable time  
41        related to the curing of the binder and drainage of the water.

1            Claim 11 (cancelled)

2            Claim 12 (cancelled)

3            Claim 13 (cancelled)

4            Claim 14 (cancelled)

5            Claim 15 (cancelled)

6            Claim 16 (cancelled)

7            Claim 17 (cancelled)

8            Claim 18 (cancelled)

9           Claim 19 (cancelled)

1           20. (Currently Amended) The method of forming an in-situ  
2           piling in a soil formation with a dry binder and sufficient water  
3           to produce a stoichiometrically correct mixture, comprising:

4                   with a rotary tool, drilling into said formation, said  
5           tool having a rotary shaft that has a central axis of rotation  
6           and a vane for drilling into and mixing the soil, rotated around  
7           and moved axially by said shaft, said vane being so disposed and  
8           arranged as to move through the formation along a helical path to  
9           drill into said formation, to stir the material of the formation,  
10           and ultimately to mix the material of the formation with water  
11           and binder;

12                   a water injector and a dry binder injector carried by  
13           said tool;

14                   driving said tool axially into and out of said  
15           formation while rotating it;

16                   at some times during axial movement of said tool,  
17           discharging-water-or-dry-binder-from-a-respective-injector-into  
18           said-soil-formation-along-a-respective-axis-of-emission-of-water  
19           or-of-said-binder,-said-axes-of-emission-being-directed-away-from  
20           said-tool-into-said-formation-at-a-respective-location-along-said  
21           central-axis,-so-that-the-material-of-their-emissions-will-during  
22           a-limited-number-of-revolutions-of-said-shaft-encounter-one

23 another,--there-to-be-mixed-as-a-pre-determined-ratio-of-water-and  
24 of-binder,--said-water-including-water-emitted-from-the-water  
25 injector-and-water-which-may-have-already-been-present-at-that  
26 depth:

27 discharging said water from said water injector into said soil  
28 formation along an axis of emission of said water and discharging  
29 said dry binder from said binder injection into said soil  
30 formation along an axis of emission of said dry binder under  
31 continuous control of the rate of supply of each, both said axes  
32 of emission being radially directed away from said tool into said  
33 soil formation at a respective location along said central axis  
34 of said shaft, so that said water and said dry binder being  
35 emitted from said water injector and said binder injector,  
36 respectively, will during a limited number of revolutions of said  
37 shaft encounter one another to become a mixture at various depths  
38 with a as a pre-determined ratio of water and dry binder, said  
39 ratio being responsive to requirements at the respective depth  
40 said water including water emitted from said water injector and  
41 water which may have already been present at that depth in said  
42 soil formation, said mixture of water and binder further  
43 including material of the formation being temporally made.

1           21. (Original) The method of claim 20 in which injection of  
2 binder is made during passage of said tool into said soil

3 formation.

1 22. (Original) The method of claim 20 in which injection of  
2 binder is made during passage of said tool out of said soil  
3 formation.

1 23. (Original) The method of claim 20 in which injection of  
2 water is made during passage of said tool into said soil  
3 formation.

1 24. (Original) The method of claim 20 in which injection of  
2 water is made during passage of said tool out of said soil  
3 formation.

1 Claim 25 (cancelled)

1 26. (Original) The method of claim 20 in which the emission  
2 of one of said injectors is encountered in said soil formation in  
3 a temporally suitable time related to the curing of the binder  
4 and drainage of the water.

1 27. (Previously Amended) The method of claim 20 in which the  
2 emission of water is determined by a program responsive to data  
3 from a representative core.

1       28.(Original) The method of claim 20 in which the emission of  
2 water is determined by a program responsive to data relating to  
3 water content already in the soil derived from a sensor on said  
4 tool disposed at an axial location below the place of injection  
5 of said binder.

1       29. (Original) The method of claim 20 in which the pressure  
2 of the stream of water and of the binder in the tool is above the  
3 ambient pressure which exists in the formation.